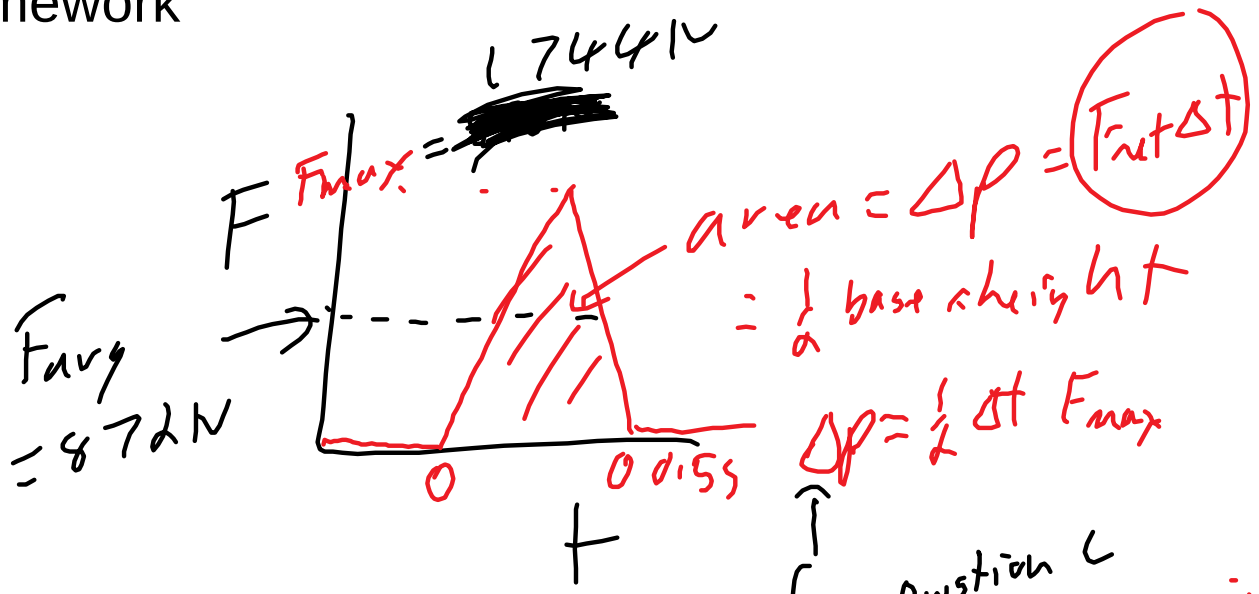
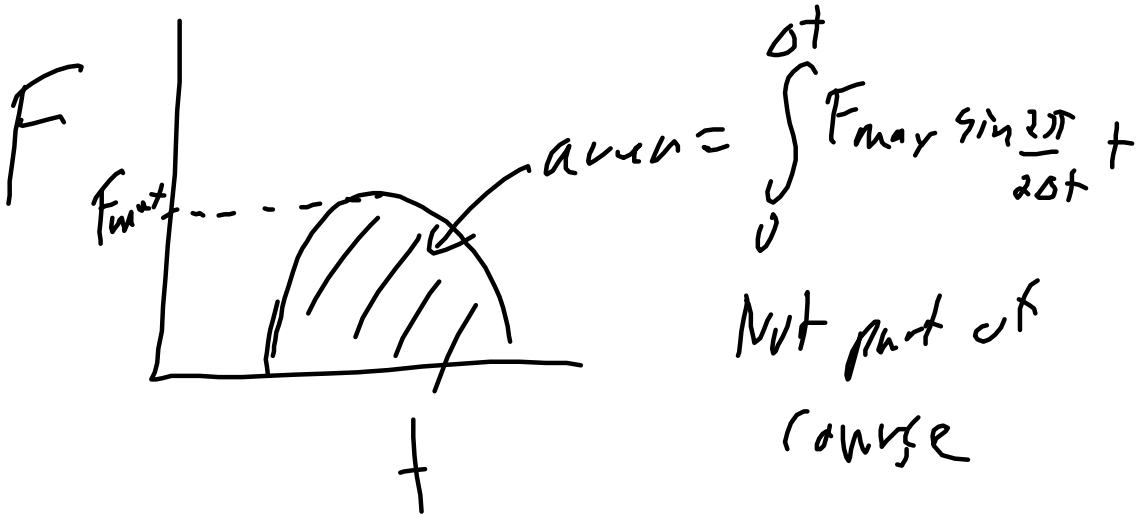
Quiz Tues Dec 13

Law of Conservation of Momentum

Homework





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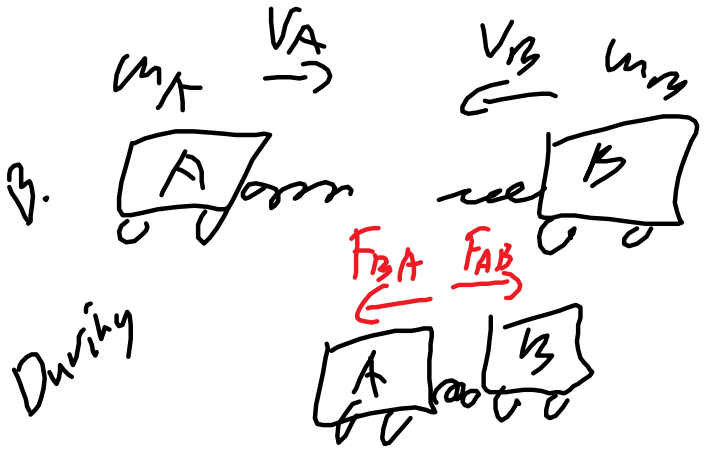

Total Momentum

$P_T = P_A + P_B$

$P_T = m_A v_A + m_B v_B$

v_B negative!

$F_{AB} = -F_{BA}$

$\Delta p = F_{net} \Delta t$

$F_{net} = \frac{\Delta p}{\Delta t}$

$\frac{\Delta p_B}{\Delta t} = -\frac{\Delta p_A}{\Delta t}$

$\Delta p_{total} = 0$

$p'_{total} = p_A' + p_B'$

$= m_A v_A' + m_B v_B'$

$\Delta p_B = -\Delta p_A$

$p_B' - p_B = -(p_A' - p_A)$

$p_B' - p_B = -p_A' + p_A$

$p_B' + p_A' = p_A + p_B$

$P_{total}' = P_{total}$ initial

momentum is conserved

assuming no external forces (friction or slopes)

Law of conservation of momentum:
the vector sum of the momentum of all the objects in a system is conserved through collisions and explosions in a closed, isolated system (no external forces/objects).

eg. A 2.0 kg cart collides with a 1.0 kg cart.

a) if the 2.0 kg cart is moving at 2.0 m/s before the collision and the carts stick together after the collision, what is the velocity of the two carts? What is the impulse on the 2.0 kg cart?
b) If the 1.0 kg cart was moving at 4.0 m/s, hits the 2.0 kg cart at rest and the 1.0kg cart bounces back at 1.0 m/s, what is the speed of the 2.0 kg cart? What is the impulse on the 2.0 kg cart?
c) You push the two carts together with a spring between them, and let go. What is the velocity of the 2.0 kg cart if the 1.0 kg cart goes off at 3.0 m/s?
d) write a paragraph about the physics of driving

on snow/ice.
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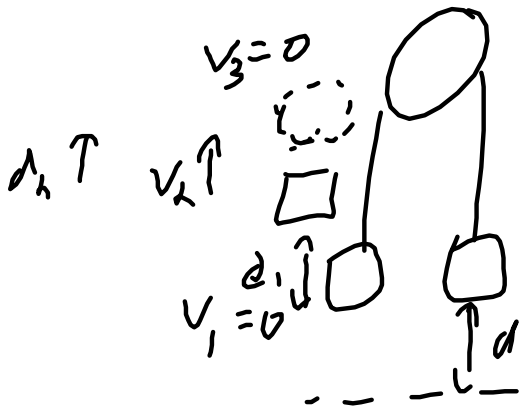
$$F_f = \mu F_N = \mu m g = F_{net} = ma$$

$$\mu = \frac{a}{g}$$

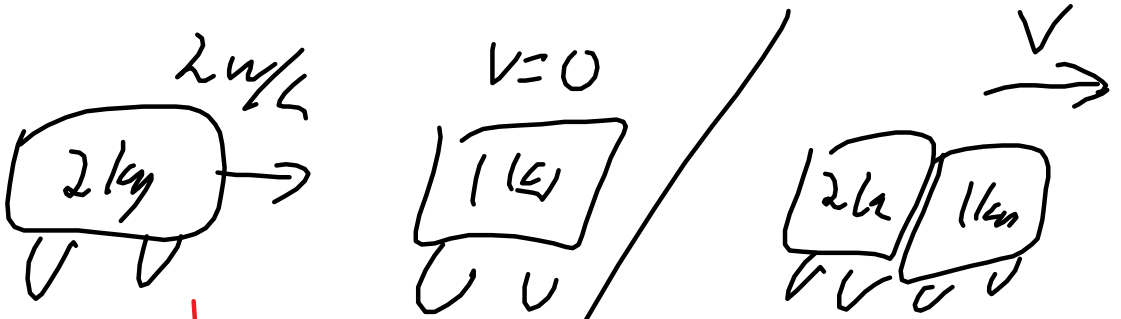


$$a = \frac{m_1 g - m_2 g}{m_1 + m_2}$$

$$v_2^2 = 2ad_1 \qquad v_3^2 = v_2^2 + 2gd_2$$

$$2d_1 + d_2 = \text{total height}$$

$$= 0.45\,m$$



$$\sum P_i = \sum P_f$$

$$P_1 + P_2 = P_{A\&B}$$

$2kg \times 2m/s + 0 = 3kg\, v_{AB}'$

$v_{AB}' = 1.3 m/s$

impulse $\Delta p = p' - p$

$= 2kg(1.3m/s) - 4kgm/s$

$= -1.3 kgm/s$

$\Delta p = p' - p$

$= 1kg(1.3m/s) - 0$

$= +1.3 kgm/s$

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4) a) $m = \frac{F_g}{g} = \frac{15\,696 N}{9.81 N/kg}$

$= 1600 kg$

b) $p = mv = 1600 \times 20$

$= 32000 kgm/s$

c) $\Delta p = p_f - p_i$

$= 0 - 32000 \text{ kgm/s}$

$= -32000 \text{ kgm/s}$

d) $\Delta p = F_{net} \Delta t$

$-32000 \text{ kgm/s} = -6.40 \times 10^2 \text{ N} \Delta t$

$\Delta t = 50 \text{ s}$